Streambank Erosion

Field Measurement Procedure

The best way to quantify streambank erosion is to measure it directly in the field. The basic procedure in measuring streambank erosion is to survey, flag, or in some way fix a “before" image of the channel you are evaluating. This establishes the baseline condition. Changes due to erosion can then be monitored over time by going back to the study area and re-measuring from your fixed reference points.

Channel cross-sections can be surveyed and plotted on a periodic basis to monitor change. Stakes or pins can be driven into channel banks flush with the surface. The amount of stake or pin exposed due to erosion is the amount of change at the streambank erosion site between your times of observation.

Field Estimate Procedure (Direct Volume Method)

The field measurement procedure is the most accurate way to measure streambank erosion. However, the time involved in monitoring your site, in wet years and dry years, often precludes this method of data collection. The Direct Volume Method can be used to estimate streambank erosion at your site. The Direct Volume Method is summarized in the following equation:

$$\frac{\text{(eroding area)}\ \text{(lateral recession rate)}\ \text{(density)}}{\text{2000 lbs/ton}} = \text{erosion in tons/year}$$

The eroding area is in square feet, the lateral recession rate is in feet/year, and density is in pounds/cubic feet (pcf).

Determining Eroding Area

Eroding areas are channel banks that are bare, rilled or gullied. They generally have sloughed soil at their bases. A grassed bank or rock bank is considered to be non-eroding. The actual eroding area is defined by multiplying the height and the length to obtain square feet of eroding area. The height is measured on the bank surface as the slope height; not the vertical height.

Average Annual Lateral Recession Rate

The average annual recession rate is the thickness of soil eroded from a bank surface (perpendicular to the face) in an average year. Recession rates are measured in feet per year. Channel erosion often occurs as chunk or blowout type erosion. A channel bank may not erode for a period of years when no major runoff events occur. When a major storm does occur, the bank may be cut back tens of feet for short distances. It is necessary to assign recession rates to banks with such a process in mind. When a bank is observed after a flood and ten feet of bank has been eroded, that ten feet must be averaged with the years when no erosion occurred. This will result in a much lower average annual recession rate than a recession rate for one storm.

Selecting the average annual lateral recession rate is the most critical step in estimating channel erosion using the direct volume method. A historical perspective is needed in many instances. Old photographs, old survey records, and any other information that helps to determine the bank condition at known times in the past are very useful data. In most instances, such information is lacking and field observations and judgement are needed to estimate recession rates.

Cultural features are often helpful in determining recession rates. Exposed bridge piers, suspended outfalls or culverts, suspended fence lines are all possible indicators of lateral recession. Discoloration on the bridge piers may show the original channel bottom elevation. Given the date of the bridge installation, a recession rate can be calculated for that reach of stream. Culverts are generally installed flush with a bank surface. The amount of culvert exposed and age of the culvert allows for the calculation of a recession rate.

Exposed tree root is probably the most common field evidence of lateral recession. Roots will not grow towards a well-drained, exposed, eroding channel bank. The amount of root exposed should be increased by at least a factor of two to account for

soil that was in the bank and that the root was growing in. By dividing the length of root exposed and the thickness of soil around the root by the age of the tree, a recession rate can be estimated.

Much experience and professional judgement are required to estimate channel recession rates. It is often not possible to directly measure recession rates in the field. Therefore, the following table has been included which relates recession rates to narrative descriptions of banks eroding at different rates.

Lateral Recession Rate (ft/yr)	Category	Description
0.01-0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06-0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
0.3-0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen trees and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes U-shaped as opposed to V-shaped.
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross section is U-shaped and stream course may be meandering.

Volume Weight Conversions

The volume (cubic feet) of eroded material is obtained by multiplying eroding areas by a lateral recession rate. To convert this volume of eroded material to a weight, the dry density of the soil must be known. The following table lists soil textures with corresponding volume weights.

Soil Texture	Volume-Weight
Clay	60-70 pcf
Silt	75-90
Sand	90-110
Gravel	110-120
Loam	80-100
Sandy loam	90-110
Gravelly loam	110-120

Example

Farmer Brown's cattle have access to the stream running through his pasture. On the south side of the stream, 700 feet of bank is bare with rills and overhanging vegetation. Exposed tree roots are evident with many fallen trees and slumps. Bank height is 8 feet measured along the bank. Soil type is predominantly sandy loam. On the north side of the stream, 300 feet of bank is predominantly bare with some rills and vegetative overhang. There are some exposed tree roots but no slumps are evident. Bank height is 10 feet and the soil texture is a loam.

Annual erosion at the site using the Direct Volume Method:

$$\frac{\text{(eroding area) (lateral recession rate) (density)}}{\text{2000 lbs/ton}} = \text{erosion in tons/year}$$

South bank:

$$\frac{\text{700 ft x 8 ft x 0.4 ft/yr x 100 pcf}}{\text{2000 lbs/ton}} = \text{112 t/yr}$$

North bank:

$$\frac{\text{300 ft x 10 ft x 0.1 ft/yr x 80 pcf}}{\text{2000 lbs/ton}} = \text{12 t/yr}$$

112 t/yr + 12 t/yr = 124 tons/year eroding at the site.